



## DE375-501N21A RF Power MOSFET

- ◆ N-Channel Enhancement Mode
- ◆ Low  $Q_g$  and  $R_g$
- ◆ High  $dv/dt$
- ◆ Nanosecond Switching
- ◆ 50MHz Maximum Frequency

Symbol	Test Conditions	Maximum Ratings	
$V_{DSS}$	$T_J = 25^\circ\text{C}$ to $150^\circ\text{C}$	500	V
$V_{DGR}$	$T_J = 25^\circ\text{C}$ to $150^\circ\text{C}$ ; $R_{GS} = 1\text{ M}\Omega$	500	V
$V_{GS}$	Continuous	$\pm 20$	V
$V_{GSM}$	Transient	$\pm 30$	V
$I_{D25}$	$T_c = 25^\circ\text{C}$	25	A
$I_{DM}$	$T_c = 25^\circ\text{C}$ , pulse width limited by $T_{JM}$	150	A
$I_{AR}$	$T_c = 25^\circ\text{C}$	21	A
$E_{AR}$	$T_c = 25^\circ\text{C}$	30	mJ
$dv/dt$	$I_S \leq I_{DM}$ , $di/dt \leq 100\text{ A}/\mu\text{s}$ , $V_{DD} \leq V_{DSS}$ , $T_J \leq 150^\circ\text{C}$ , $R_G = 0.2\Omega$	5	V/ns
	$I_S = 0$	>200	V/ns
$P_{DC}$		940	W
$P_{DHS}$	$T_c = 25^\circ\text{C}$ Derate $3.7\text{ W}/^\circ\text{C}$ above $25^\circ\text{C}$	425	W
$P_{DAMB}$	$T_c = 25^\circ\text{C}$	4.5	W
$R_{thJC}$		0.16	C/W
$R_{thJHS}$		0.36	C/W

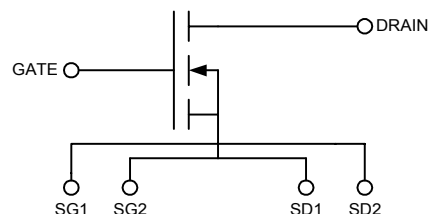
Symbol	Test Conditions	Characteristic Values		
		$T_J = 25^\circ\text{C}$ unless otherwise specified		
		min.	typ.	max.
$V_{DSS}$	$V_{GS} = 0\text{ V}$ , $I_D = 3\text{ ma}$	500		V
$V_{GS(th)}$	$V_{DS} = V_{GS}$ , $I_D = 4\text{ ma}$	2.5		5.5 V
$I_{GSS}$	$V_{GS} = \pm 20\text{ V}_{DC}$ , $V_{DS} = 0$			$\pm 100\text{ nA}$
$I_{DSS}$	$V_{DS} = 0.8\text{ V}_{DSS}$ , $T_J = 25^\circ\text{C}$ $V_{GS} = 0$ , $T_J = 125^\circ\text{C}$			50 $\mu\text{A}$ 1 mA
$R_{DS(on)}$	$V_{GS} = 15\text{ V}$ , $I_D = 0.5I_{D25}$ Pulse test, $t \leq 300\mu\text{s}$ , duty cycle $d \leq 2\%$			0.22 $\Omega$
$g_{fs}$	$V_{DS} = 15\text{ V}$ , $I_D = 0.5I_{D25}$ , pulse test		17	S
$T_J$		-55		+175 $^\circ\text{C}$
$T_{JM}$			175	$^\circ\text{C}$
$T_{stg}$		-55		+175 $^\circ\text{C}$
$T_L$	1.6mm (0.063 in) from case for 10 s		300	$^\circ\text{C}$
Weight			3	g

$$V_{DSS} = 500\text{ V}$$

$$I_{D25} = 25\text{ A}$$

$$R_{DS(on)} = 0.22\ \Omega$$

$$P_{DC} = 940\text{ W}$$



### Features

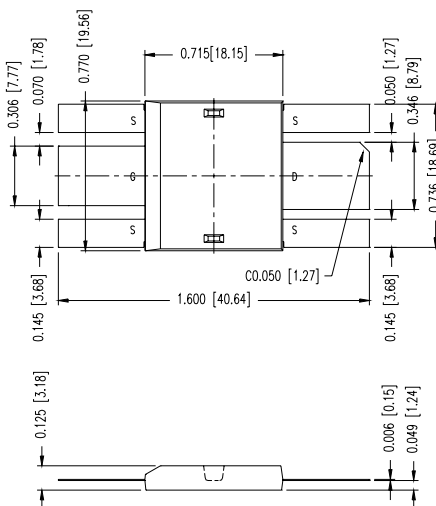
- Isolated Substrate
  - high isolation voltage (>2500V)
  - excellent thermal transfer
  - Increased temperature and power cycling capability
- IXYS advanced low  $Q_g$  process
- Low gate charge and capacitances
  - easier to drive
  - faster switching
- Low  $R_{DS(on)}$
- Very low insertion inductance (<2nH)
- No beryllium oxide (BeO) or other hazardous materials

### Advantages

- Optimized for RF and high speed switching at frequencies to 50MHz
- Easy to mount—no insulators needed
- High power density

**Symbol      Test Conditions      Characteristic Values**  
 ( $T_J = 25^\circ\text{C}$  unless otherwise specified)

		min.	typ.	max.
$R_G$			0.3	$\Omega$
$C_{iss}$			2000	pF
$C_{oss}$	$V_{GS} = 0\text{ V}, V_{DS} = 0.8 V_{DSS(max)}, f = 1\text{ MHz}$		200	pF
$C_{rss}$			45	pF
$C_{stray}$	Back Metal to any Pin		33	pF
$T_{d(on)}$			5	ns
$T_{on}$	$V_{GS} = 15\text{ V}, V_{DS} = 0.8 V_{DSS}, I_D = 0.5 I_{DM}$		3	ns
$T_{d(off)}$	$R_G = 0.2\ \Omega$ (External)		5	ns
$T_{off}$			8	ns
$Q_{g(on)}$			77	nC
$Q_{gs}$	$V_{GS} = 10\text{ V}, V_{DS} = 0.5 V_{DSS}, I_D = 0.5 I_{D25}$		21	nC
$Q_{gd}$			40	nC



**Source-Drain Diode      Characteristic Values**  
 ( $T_J = 25^\circ\text{C}$  unless otherwise specified)

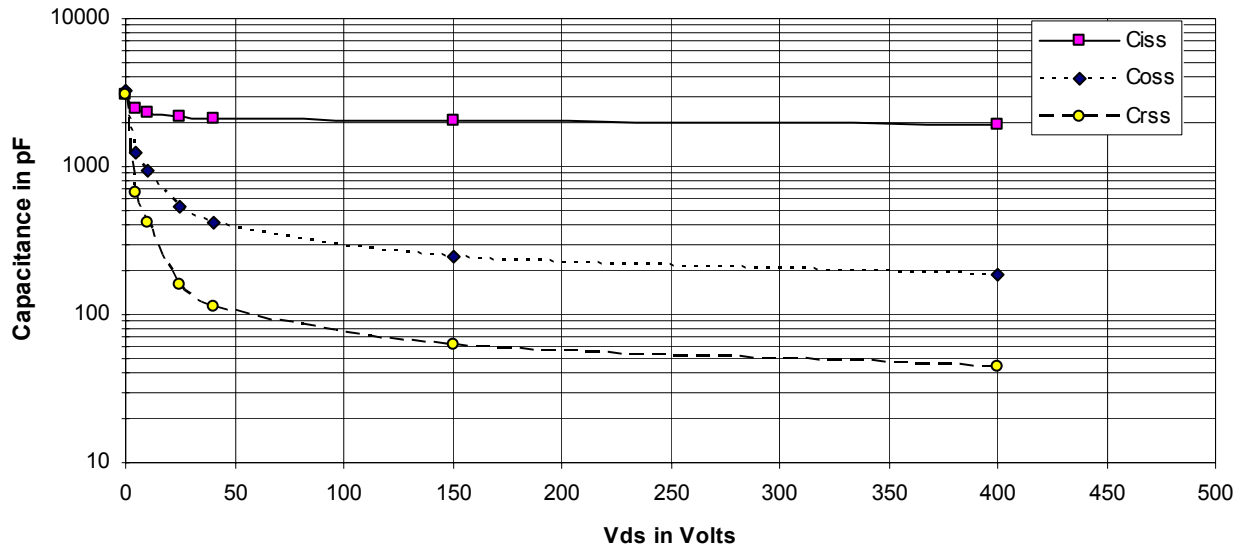
Symbol	Test Conditions	min.	typ.	max.
$I_S$	$V_{GS} = 0\text{ V}$			21 A
$I_{SM}$	Repetitive; pulse width limited by $T_{JM}$			150 A
$V_{SD}$	$I_F = I_S, V_{GS} = 0\text{ V},$ Pulse test, $t \leq 300\ \mu\text{s}$ , duty cycle $\leq 2\%$			1.5 V
$T_{rr}$			200	ns
$Q_{RM}$	$I_F = I_S, -di/dt = 100\text{ A}/\mu\text{s}, V_R = 100\text{ V}$		0.6	$\mu\text{C}$
$I_{RM}$			15	A

For detailed device mounting and installation instructions, see the “*DE-Series MOSFET Mounting Instructions*” technical note on IXYS RF’s web site at [www.ixysrf.com/Technical\\_Support/App\\_notes.html](http://www.ixysrf.com/Technical_Support/App_notes.html)

IXYS RF reserves the right to change limits, test conditions and dimensions.

IXYS RF MOSFETS are covered by one or more of the following U.S. patents:

4,835,592	4,850,072	4,881,106	4,891,686	4,931,844	5,017,508
5,034,796	5,049,961	5,063,307	5,187,117	5,237,481	5,486,715
5,381,025	5,640,045				



**375-501N21A Capacitances vs Vds**

### 501N21A DE-SERIES SPICE Model (Preliminary)

The DE-SERIES SPICE Model is illustrated in Figure 1. The model is an expansion of the SPICE level 3 MOSFET model. It includes the stray inductive terms  $L_G$ ,  $L_S$  and  $L_D$ .  $R_d$  is the  $R_{DS(ON)}$  of the device,  $R_{ds}$  is the resistive leakage term. The output capacitance,  $C_{OSS}$ , and reverse transfer capacitance,  $C_{RSS}$  are modeled with reversed biased diodes. This provides a varactor type response necessary for a high power device model. The turn on delay and the turn off delay are adjusted via  $R_{on}$  and  $R_{off}$ .

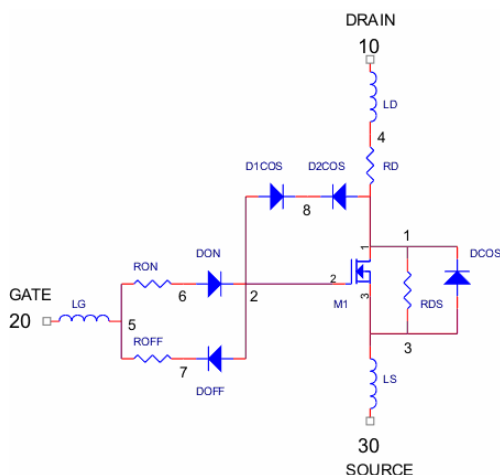


Figure 1 DE-SERIES SPICE Model

This SPICE model may be downloaded as a text file from the DEI web site at [www.directedenergy.com/spice.htm](http://www.directedenergy.com/spice.htm)

Net List:

```
.SUBCKT 501N21A 10 20 30
```

\* TERMINALS: D G S

\* 500 Volt 21 Amp 0.22 ohm N-Channel Power MOSFET

\* REV.A 01-09-02

```
M1 1 2 3 3 DMOS L=1U W=1U
```

RON 5 6 0.3

DON 6 2 D1

ROF 5 7.1

DOF 2 7 D1

D1CRS 2 8 D2

D2CRS 1 8 D2

CGS 2 3 2.6N

RD 4 1 0.22

DCOS 3 1 D3

RDS 1 3 5.0MEG

LS 3 30 .5N

LD 10 4 1N

LG	20	5	1N
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```
.MODEL DMOS NMOS (LEVEL=3 VTO=3.0 KP=3.8)
```

```
.MODEL D1 D (IS=.5F CJO=1P BV=100 M=.5 VJ=.6 TT=1N)
```

```
.MODEL D2 D (IS=.5F CJO=400P BV=1000 M=.4 VJ=.6 TT=400N RS=10M)
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.MODEL D3 D (IS=.5F CJO=900P BV=1000 M=.3 VJ=.4 TT=400N RS=10M)

.ENDS

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